

THE HYDROGEN ECONOMY

Opportunities Missed?

- ▣ VISION
- ▣ LEADERSHIP
- ▣ INNOVATION
- ▣ COLLABORATION
- ▣ EDUCATION
- ▣ FUNDING STEAMS

“Montana Vision 2020”

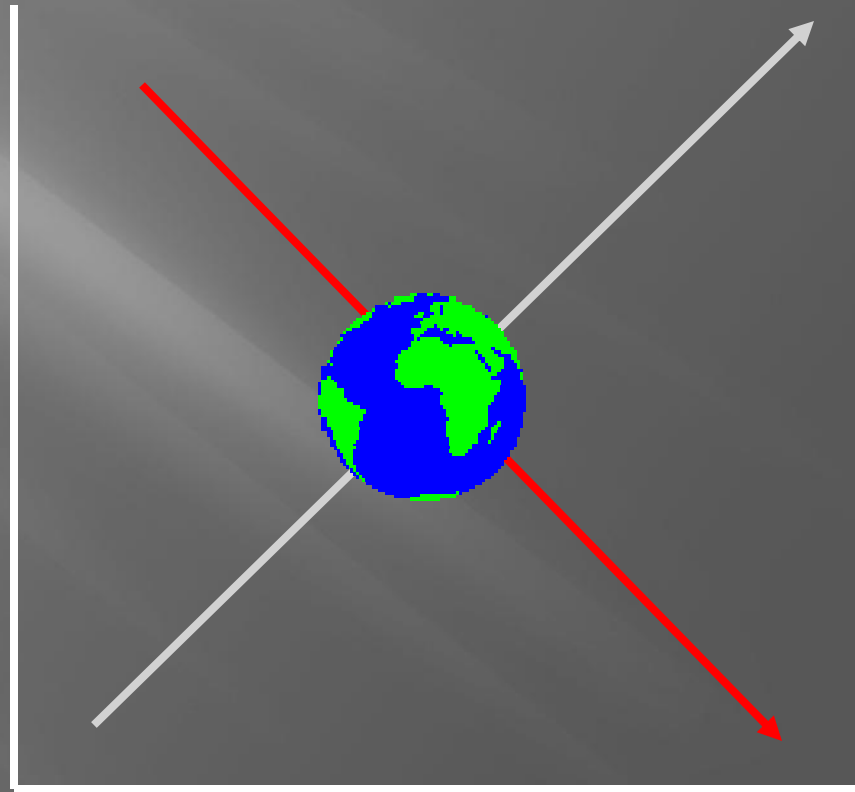
- ▣ Montana: The BEST Positioned for a H2 Economy
- ▣ Hydrogen Economy Endorsement--2003 House Joint Resolution No. 26
- ▣ State-wide Interest to Lead Invigorated Economy
 - Ed.; Business; Jobs; Infrastructure; Social Programs
- ▣ On the Precipice of the Greatest Opportunity in Economic History
- ▣ National Leadership: *MV2020*
- ▣ Montana Chose to Muddle in the Moment

OUR ENERGY FUTURE

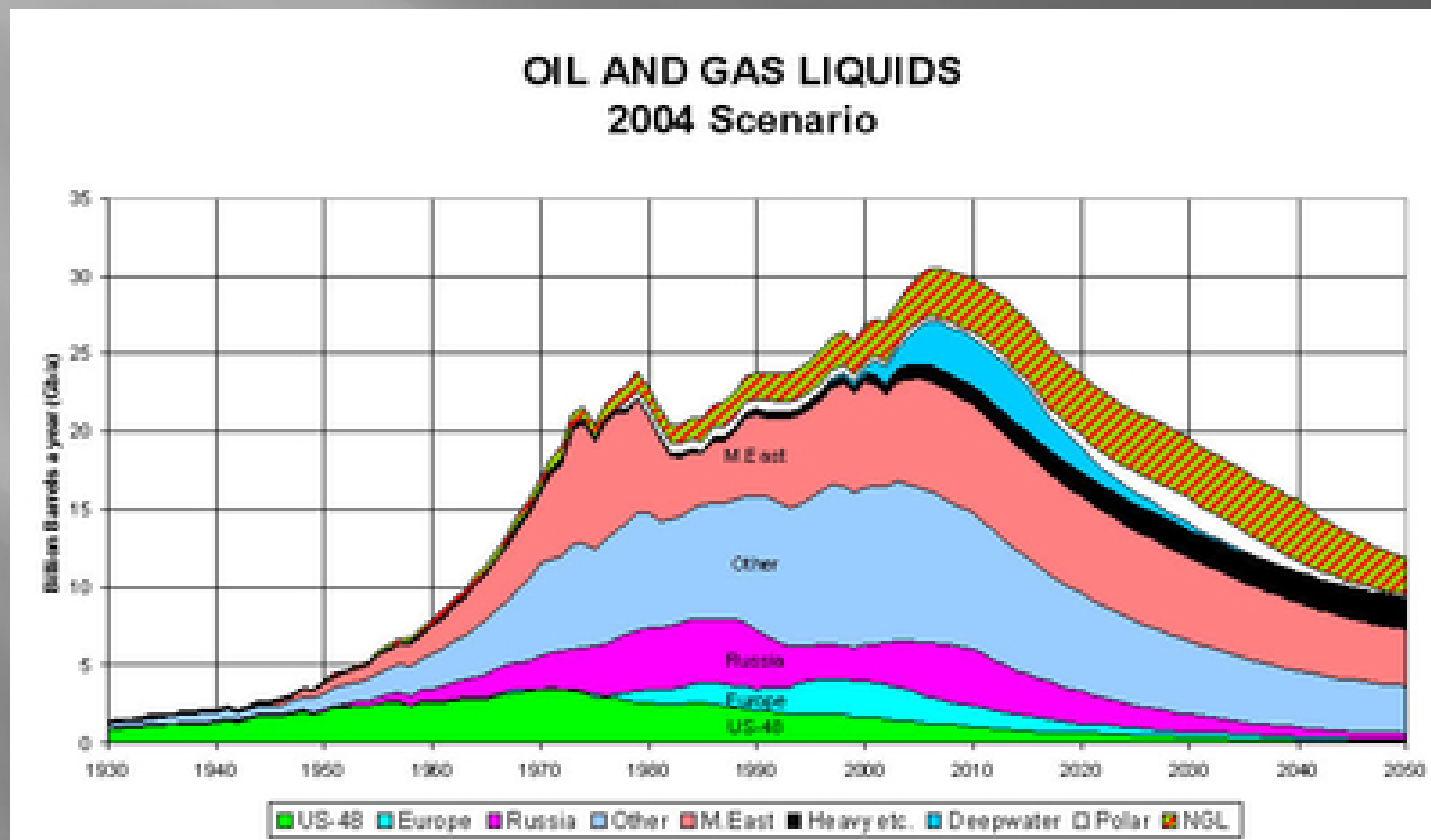
Hydrogen's Elegant Energy Solution

The Perfect Storm = Perfect Opportunity

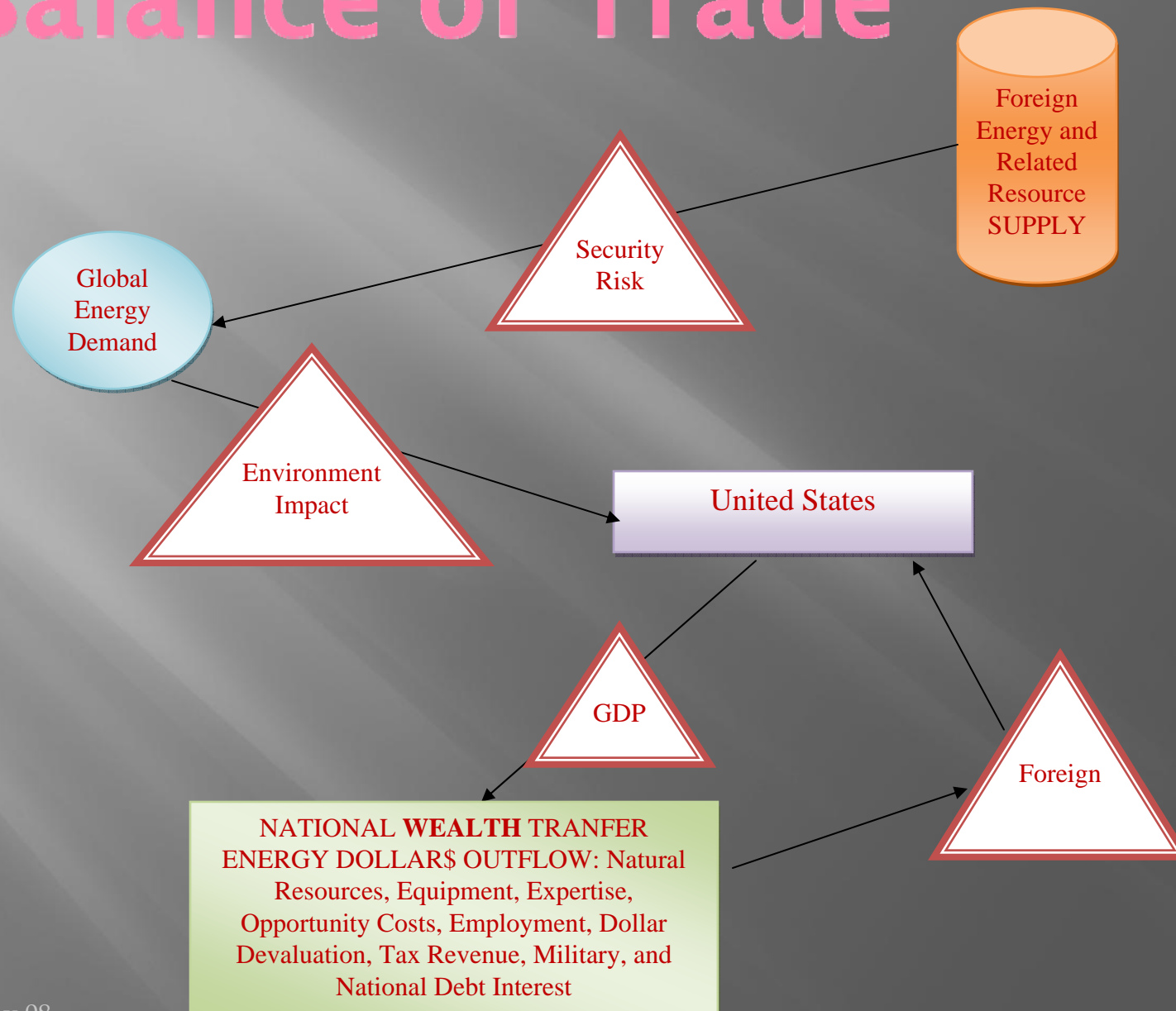
Petroleum Supply
Energy Ldrship & Ed
Energy Infrastructure
Balance of Payments
Innovation & Ed.
Sustainable Living
Sc/Engineer Ldrship
Quality of Life
Gov't Will & Coop
Water Needs
Carbon and CO2
Global Wmg & Poll.
Energy Demands
NIMBY
Transportation Impact
Terrorism/Espionage
Deficit Spending
Utility and Energy Costs
Commodity Prices
Military Resources
Consumption



Petroleum Supplies



Balance of Trade



New Energy Future

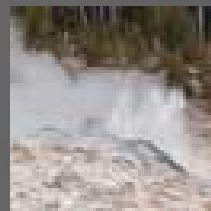
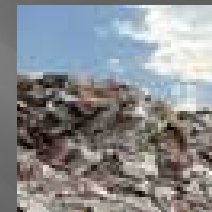
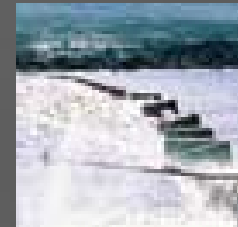
- ▣ Sustainable and Pollution Free Existence
- ▣ More Globally-based Energy Demand
- ▣ Enlightened Policy Making
- ▣ Research Breakthroughs
- ▣ Creation of Eco-nomics
- ▣ Regained U.S. Intellectual Leadership
- ▣ Infrastructure Revolution
- ▣ Enlightened Natural Resource Management
- ▣ Enhanced Innovation & World Competiveness
- ▣ Shifting Quality of Life & Lifestyles
- ▣ Reestablished Energy Independence
- ▣ Regained Competiveness
- ▣ Development of a Hydrogen Economy



Elegant Energy Solution

▣ Hydrogen Economy's Clean and Abundant Energy Umbrella:

- Conservation
- Wind, Solar, Biomass
- Batteries, Electric Motors
- Coal, Petroleum, Natural Gas
- Hydro, Wave, Geothermal
- Nuclear, Fusion
- Gerbils



Spheres of Influence

- ❖ Energy
- ❖ Education
- ❖ Business
- ❖ Industrial Complex
- ❖ Transportation
- ❖ Military
- ❖ National Security
- ❖ Power Transmission
- ❖ Carbon Footprint
- ❖ Pharmaceuticals
- ❖ Housing
- ❖ Agriculture
- ❖ Plastics & Resins
- ❖ Recreation
- ❖ Climate Change
- ❖ Energy Infrastructure
- ❖ Economic/Wkfr. Devel.
- ❖ Health
- ❖ Quality of Life
- ❖ Research

Hydrogen Status

While Montana has been Waiting.....

The Hydrogen Future has Evolved:

- ▣ Hydrogen Storage
- ▣ Hydrogen Production
 - Energy Sources: Renewable, Grid
 - Methods: Reforming, Gasification, Electrolysis
- ▣ Hydrogen Use
 - Vehicles, Power Generation, Grid



Implementation- Hydrogen Generation, Storage and Distribution

- ▣ Hydrogen and Alternative Energy Safety Training Site(DoE & DoT): Applied Research



Implementation- Hydrogen Fuel Cells & Hydrogen Safety

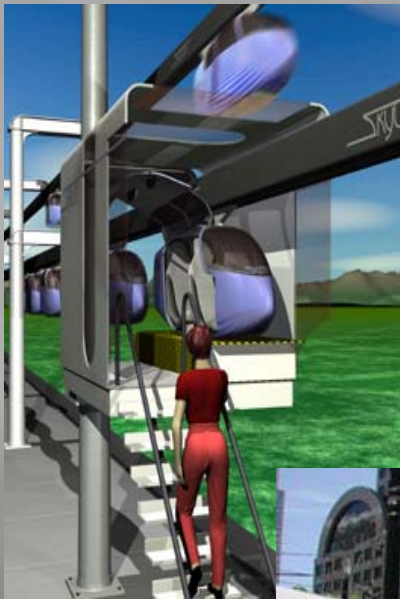
- ▣ National Hydrogen Safety Training for First Responders (DoT, DoE, Natl Org): Education
 - National Alternative Fuels Training Consortium, West Virginia University.
- ▣ Hydrogen Separation and Purification (99.999) with Palladium (DoT): Basic Resh.
 - Center for Advanced Mineral and Metallurgical Process Engineering, Montana Tech.



Implementation- Private Rapid Transit (PRT)

- ▣ Hydrogen Powered, Magnetic-Levitation Monorail System (DoT): Basic & Applied Research
 - Bogies/Vehicles – Los Angeles
 - Linear Motors and MagLev – Seattle
 - Computer Programming – University California and West Virginia University
 - Assembly and Demonstration – University of Montana

H2 MagLev Monorail



Implementation – Alternative Energy Research

- ▣ Biomass Co-Gen Mobile Facility (USDA):
Applied Research.



New Energy Paradigm

- Elegant Energy Solution
 - Advanced Alternative Energy Generation Technologies
- Environmentally Friendly
 - CO₂ Sequestration
- Efficient and Cost Effective
- National Alternative Energy Bond Fund



Hydrogen- Transportation's Only Answer

- ▣ Meet energy demand needs by mid-century
- ▣ Achieve energy independence
- ▣ Cut greenhouse gases 60% below 1990 levels
- ▣ Eliminate virtually all urban air pollution by 2100

Preliminary Results - Rankings

DRAFT

Overall Summary of Transportation Market Comparison Ratings

	Near-Term (2008-2012)		Mid-Term (2013-2025)		Long-Term (2026-2050+)	
	Economic Vitality		Economic Vitality		Economic Vitality	
Propulsion Option	Vehicle Cost Ownership Cost	Fuel Cost	Vehicle Cost Ownership Cost	Fuel Cost	Vehicle Cost Ownership Cost	Fuel Cost
<i>Weighting Factor</i>	1	1	1	1	1	1
Gasoline ICEV (Baseline)	9		8		3	
Gasoline HEV	7		6		4	
Gasoline Plug-in HEV	8		10		8	
Diesel HEV	6		5		4	
EtOH ICEV	10		9		5	
EtOH HEV	7		6		5	
EtOH Plug-In HEV	8		10		8	
H2 ICEV HEV	4		3		7	
H2 FC HEV	1		7		10	
H2 FC Plug-In HEV	1		4		8	
All Electric Vehicle	2		1		2	

The Challenge

- ▣ Collateral Advancements
- ▣ Strategic Economic Existence
- ▣ Leveraged Possibilities
- ▣ Generational Dependence
- ▣ Planet's Future
- ▣ Energy Independence
- ▣ National Security
- ▣ Carbon Sequestration
- ▣ National Wealth Retention

Key Choices

- ▣ Lead or Follow
 - ▣ Innovate or Stagnate
 - ▣ Collaborate or Isolate
 - ▣ Proactive or Reactive Education
 - ▣ New vs. Zero Sum Funding Sources
 - ▣ Exhibit Courage- look past the present.
- Remember, there is only one special interest group: Our Children's Children 2107

Thank You So Much

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Hydrogen and Alternative Energy R&D
(P.S. H2 Bus Conf.)